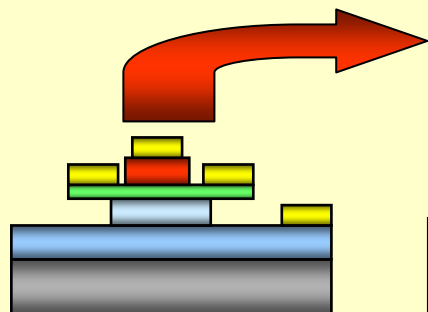
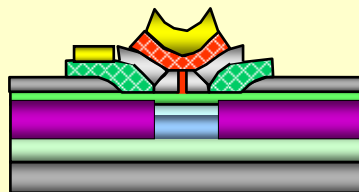




Technology for Frequency Agile Digitally Synthesized Transmitters (TFAST)

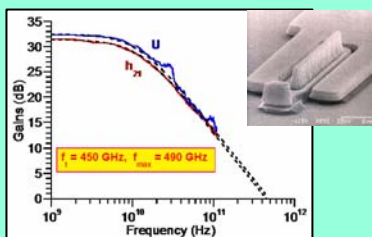


Conventional Mesa InP HBT



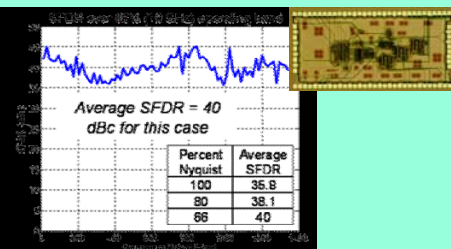
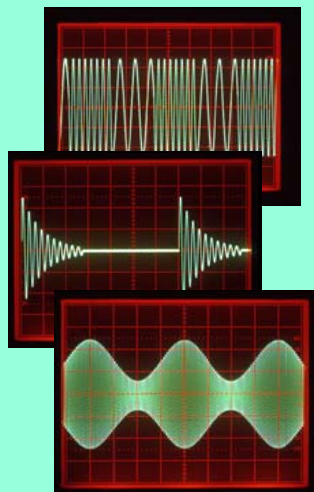
TFAST Scaled InP HBT

**3x higher circuit speed
10x higher integration
10x lower power**



$f_t/f_{max} = 450/490 \text{ GHz}$

**TFAST enables
high-speed digitally
synthesized waveforms**



**30GHz DDS with >40 dB SFDR
and >30% AC Yield**

High-Speed Mixed Signal Circuits (DACs & ADCs) for High Dynamic Range Antenna Applications

• Goal

- Develop super-scaled ultra-fast Indium Phosphide (InP) Heterojunction Bipolar Transistors (HBTs) for use in complex mixed signal circuits enabling 3X higher circuit speed, 10X higher integration, and 10X lower power

• Technical Challenges

- Super-scaled ultra-fast InP HBTs (>400 GHz)
- High yield, large-scale Integration (~20,000 transistors)
- High-speed mixed signal circuit designs, i.e. Digital-to-Analog Converters (DACs), Analog-to-Digital Converters (ADCs) and Direct Digital Synthesizers (DDSs)

• Key Accomplishments

- Record 450/490 GHz of f_t/f_{max} was achieved
- Record 710 GHz F_t was demonstrated
- Record DDS operating at 30 GHz clock speed with >40 dBc Spurious Free Dynamic Range (SFDR) to 12 GHz output frequencies

• Impact

- High speed, high voltage HBTs will extend mixed signal circuits (DACs, ADCs, DDSs) to operation at microwave clock frequencies.
- Revolutionize microwave systems via direct digital generation and detection of analog waveforms up to 30 GHz.
- EW, COMMS, Radar

